Fifth Annual Conference on Carbon Capture & Sequestration

Steps Toward Deployment

Geologic – Monitoring, Mitigation, and Verification

Development of MM&V Models for Geologic Sequestration

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ICET

ICET Role in Southeast Regional Carbon Sequestration Partnership "SECARB" Phase II

- Task 7 MM&V Crosscut Support
- Subtask 7.1 Identify Emerging Technologies to Fill MMV Gaps
  - Instrumentation and Application Information
  - Model Development
- Subtask 7.2 Support Field Validation MM&V
  - Direct Support
    - UTA BEG Stacked Storage
    - VA Tech AGS Coal Seams
    - ARI EPRI Saline Formation
  - Model Validation

MM&V Models

- Overriding goal - account for 95% of the CO_2 – at less than 10% of total emplacement cost (NETL Technology Roadmap and Project Plan – 2005)
- Development of a callable database that includes available instrumentation, associated costs, measurement frequency, QA/QC, accounting
- Allows for down-selection of most appropriate instrumentation for a given sequestration opportunity (site characteristics)
- Identifies instrumentation gaps, redundancy and emerging monitoring needs – tracks system development and deployment

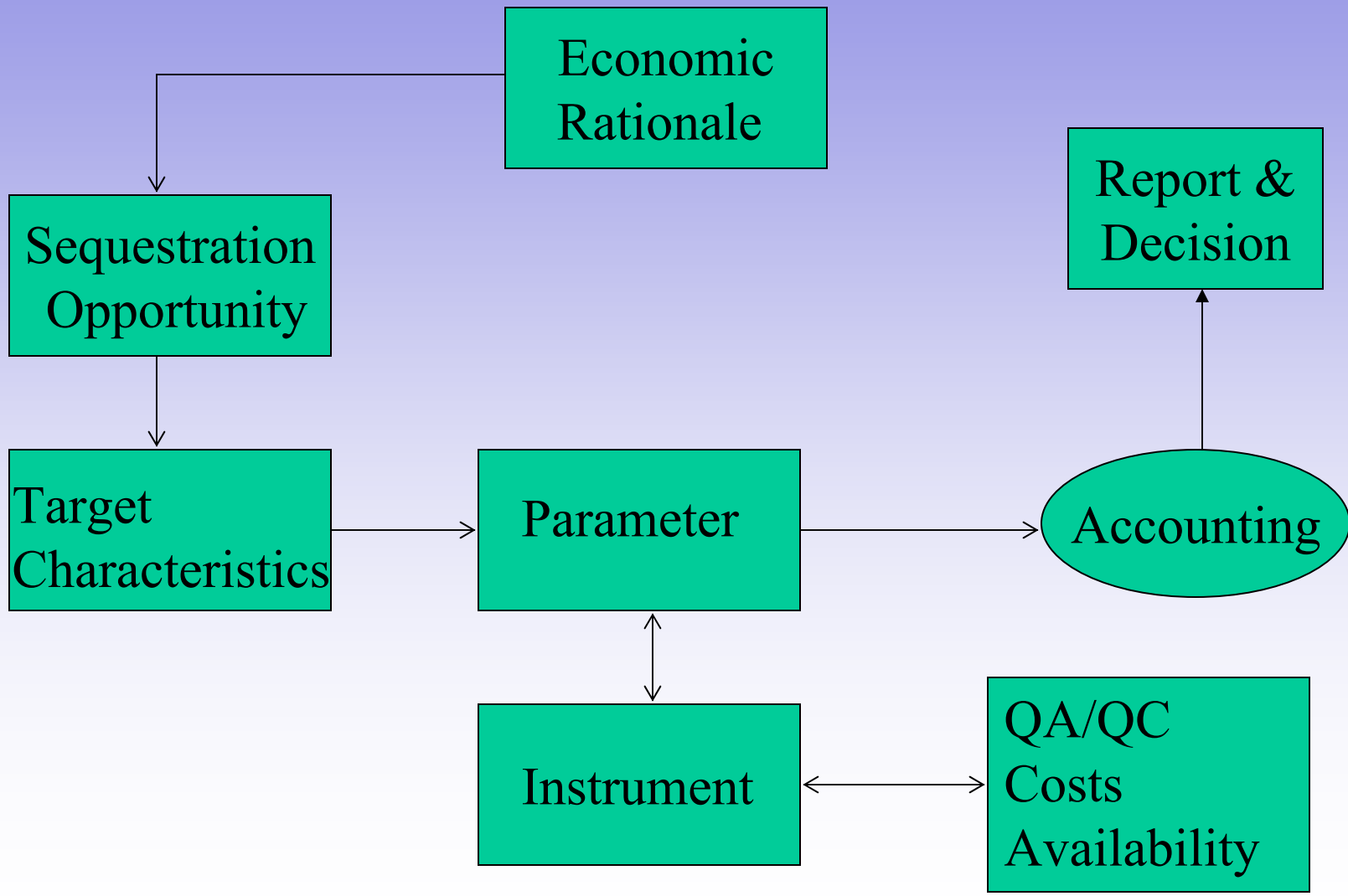
Database Development Path

- Evaluate Carbon Accounting Frameworks, DOE Roadmap and EIA 1605B
- Development of Site Specific MMV Models
- Model Testing with Available Data
- Apply Model to SECARB Phase II Demonstration Projects - Assess Completeness
- Compare Model Predictions to Results
- Model Refinements
- Model Validation, Application, and Future Directions
- Reporting and Database Distribution

Database Structure

- Sequestration Site Characteristics
- Infrastructure
  - source plant operations
  - transportation/pipelines
- Commonalities
  - surface
  - aquifers
  - leakage
- Instrument Descriptions, Costs, QA/QC, measurement uncertainty, and Availability
- Number of Instruments Required, Frequency

Functionality Classification Package



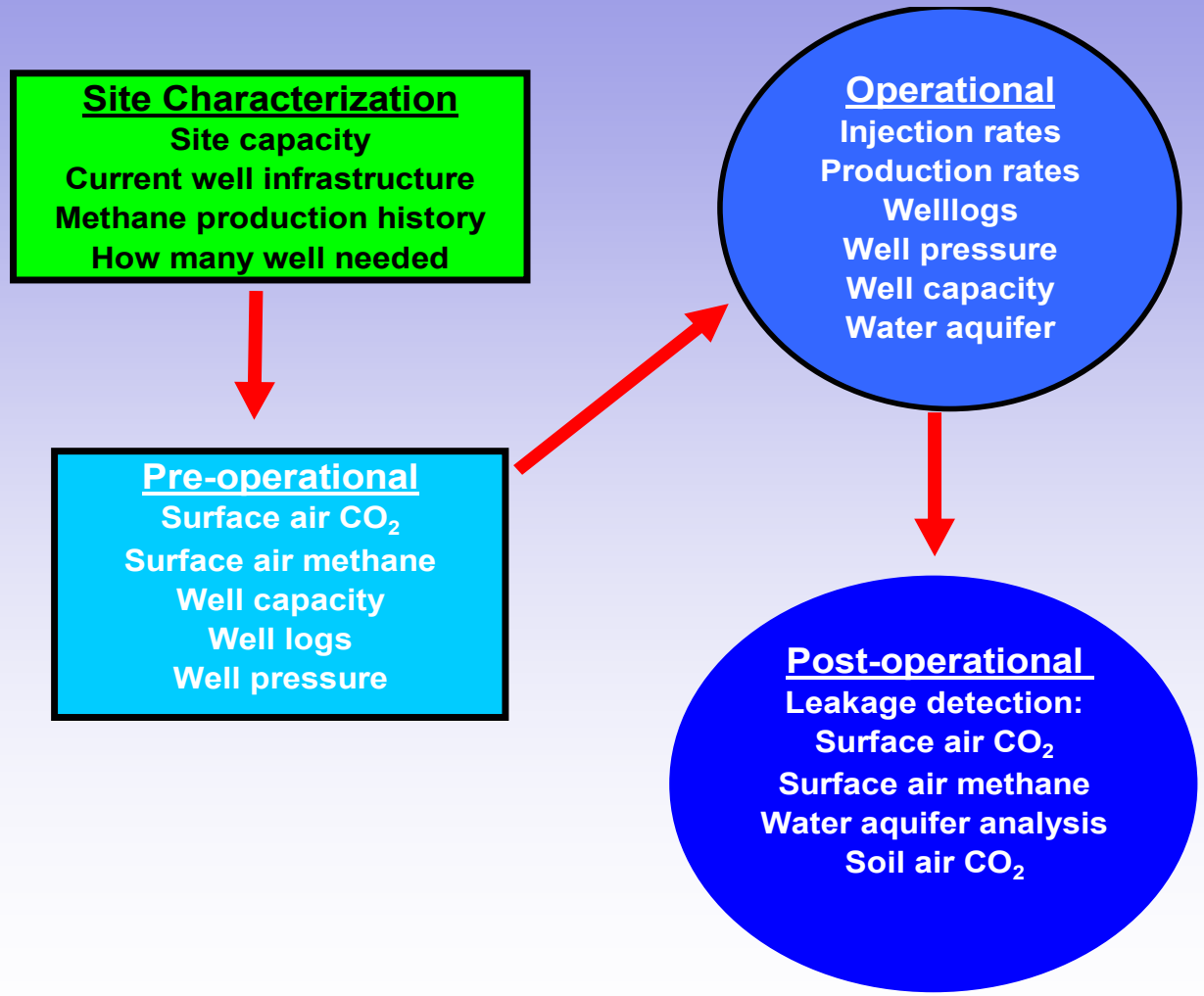
Examples of Scenarios and MM&V Targets

Scenario ID	Scenario	MMV Target	MMV Target ID
S100	Saline sequestration	Reservior Characteristics	T1**
S110	Saline sequestration	Characterizing brine samples	T2**
S120	Saline sequestration	Characterizing fresh water samples	T3**
S130	Saline sequestration	Characterizing atmospheric air	T4**
S140	Saline sequestration	Surface topography	T5**
S150	Saline sequestration	Soil Measurement	T6**
S160	Saline sequestration	Well integrity	T7**
S170	Saline sequestration	Monitoring Injection and postinjection	T8**
S200	Enhanced oil production		
S300	Coalbed methane production		

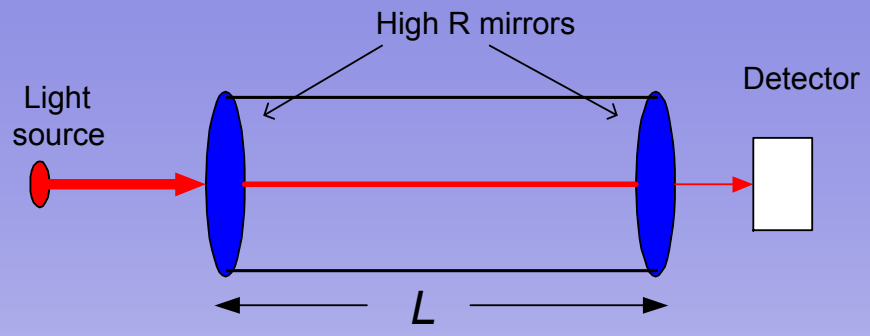
Example of Instrument Table

Instrument ID	Instrument Name	Instrument Cost	Instrument Function	Instrument Operational Cost
In10	ICP AES	$0.00	Fe, Mn, Ca. Mg, As, Se, Cd, Zn, Pb	$0.00
In100	Pressure	$0.00	Pressure	$0.00
In110	Temperature	$0.00	Temperature	$0.00
In120	CRDS	$100,000.00	CO2 and isotope	$0.00
In130	Eddy tower	$0.00	CO2	$0.00
In140	Flux accumulation chamber	$0.00	CO2	$0.00
In150	Tilmeters	$0.00	Surface topography	$0.00
In160	Seismic	$0.00	Plume migration	$0.00

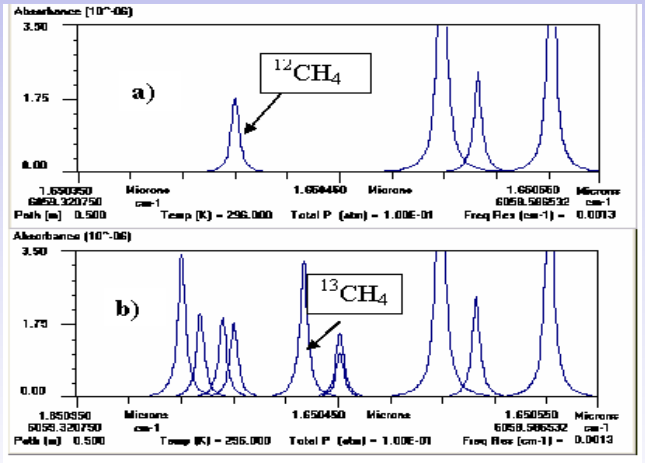
Example of Application to Enhanced Coalbed Methane



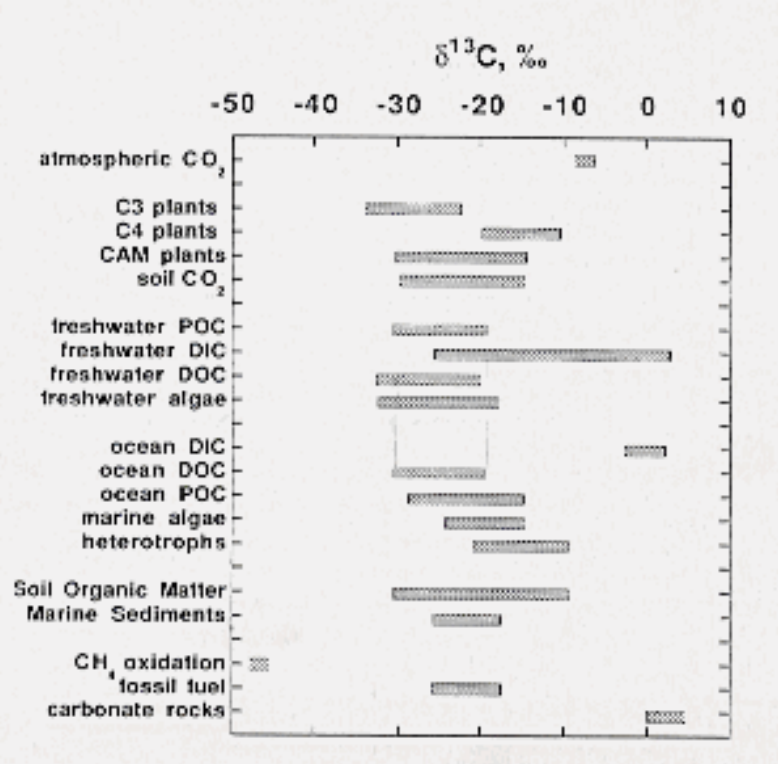
Identified Issue

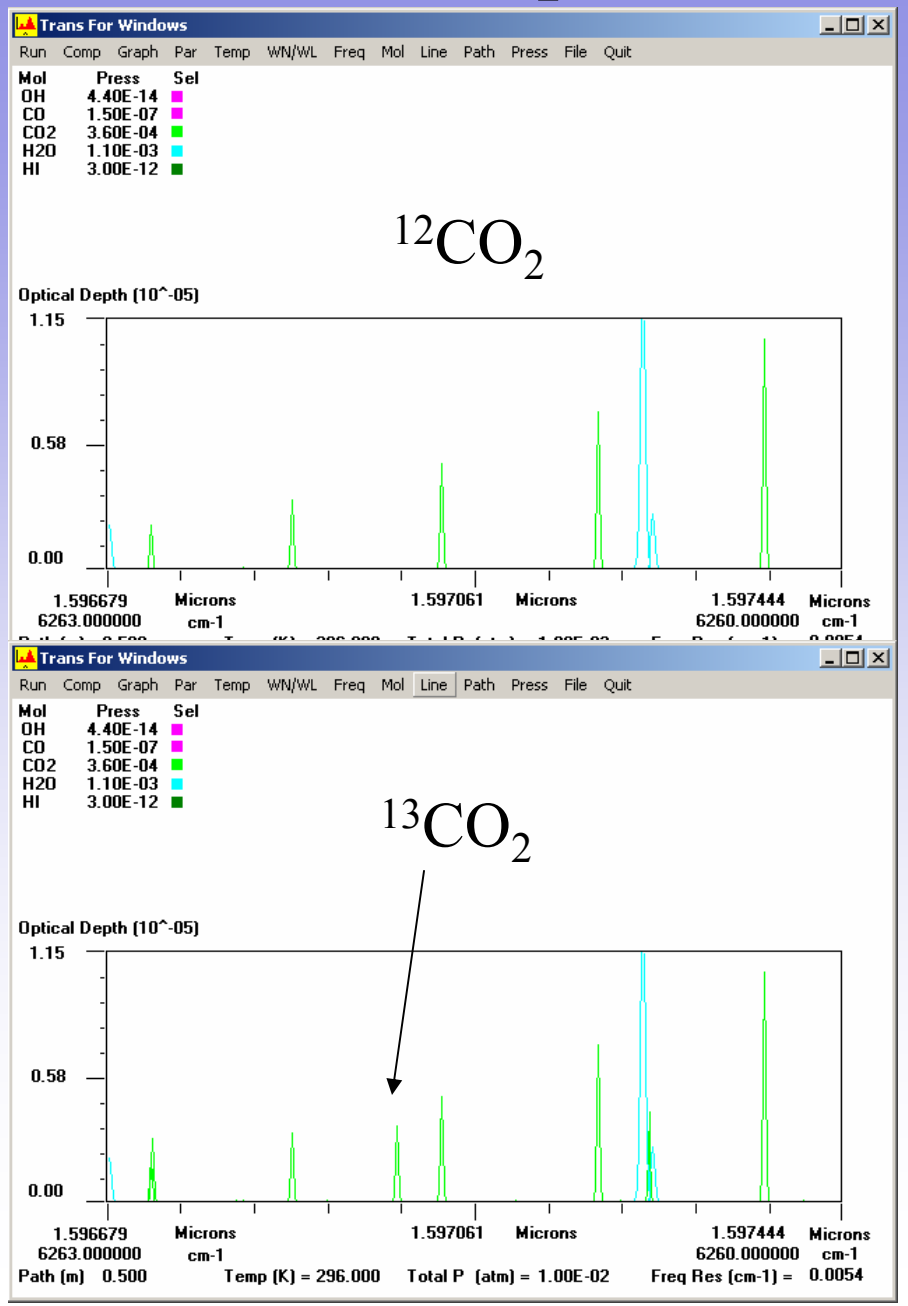


- Instrumentation is needed for rapid discrimination of ambient and sequestered CO_2
- Portable Cavity Ringdown Spectrometer
  Chuji Wang (DOE-NETL Grant # DE-RQ26-05NT500832)
  - Portable Unit -weight 30 lbs, CO_2: 300-2500 ppm, 0.3 - 25 ppm
  - 1 per mil for δ C-13, CH4: 0.5-1 ppm



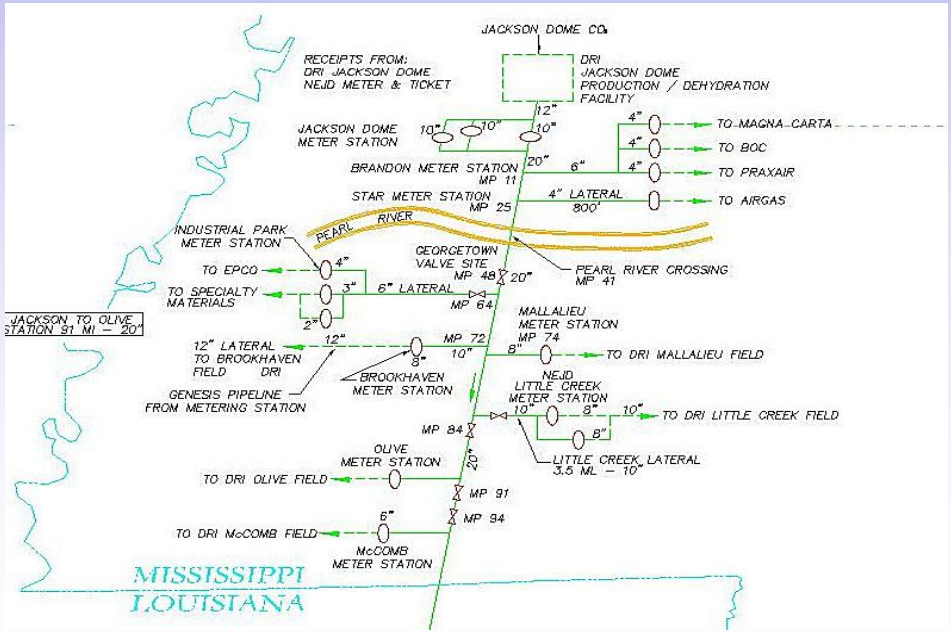
Real-Time Discrimination of C-13 Isotopes





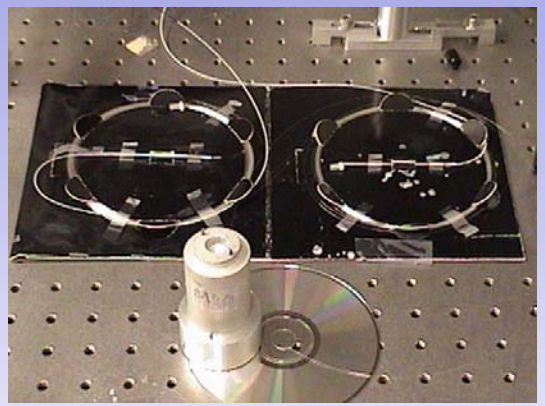
Identified Issues

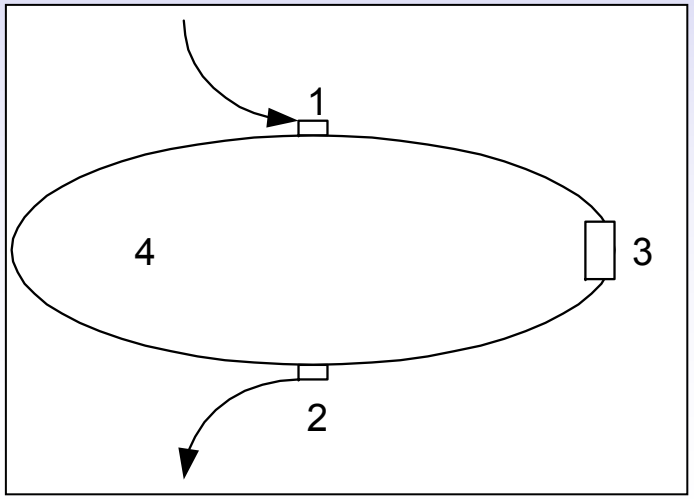
- Project Roadmap needs to include MM&V plan for expected increase in infrastructure
- Total CO_2 tracking from the source to the sink is needed
- Pipelines
  - Remote Sensing
  - CRDS
  - Water

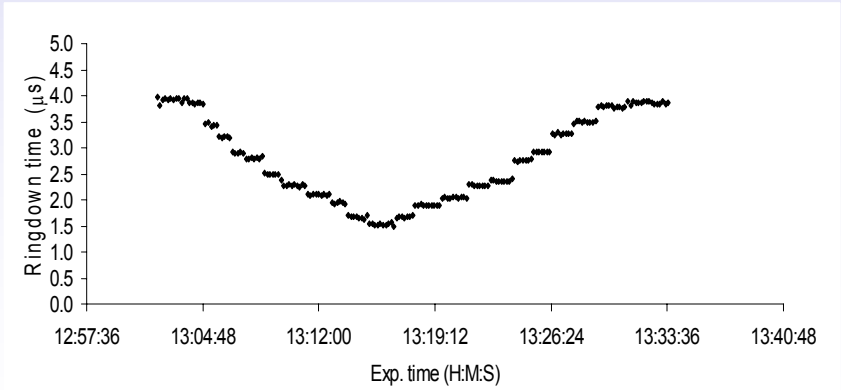


Large increase in use of fiber optics for down-hole measurements
Fiber Ringdown Sensor

1:light beam coupled into the loop;
2:optical signal coupled to a photodetector;
3:sensor head;
4:fiber loop.







Conclusions and Path Forward

- Work has been initiated on the development of an application package for down-selection of monitoring needs for various geological sequestration opportunities
- Needs have been identified for discrimination of ambient and sequestered CO_2.
- Infrastructure MM&V should be considered for future large-scale sequestration activities

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